The Effects of a Computer-Assisted Reminder System on Patient Compliance With Recommended Health Maintenance Procedures

E. Chris Vincent, M.D.[1], Philip A. Hardin, Ph.D.[2], Lee A. Norman, M.D., M.B.A., M.H.S.[1], Elizabeth A. Lester, B.A.[2], and Scott H. Stinton, B.A.[1]

[1]Swedish Family Medicine, Swedish Hospital, Seattle, WA and
[2]CYBIS Medical Systems, Bellevue, WA

ABSTRACT

In June of 1993 we implemented a computer-assisted reminder system in the outpatient clinic of an 18 resident family practice training program. The system notifies both patients and physicians of recommended health maintenance procedures. In the 22 months following implementation we documented a rapid increase in physician and patient compliance with several disease screening and prevention services. Despite high physician compliance, we were unable to increase patient compliance rates above 70% for any procedure. At the end of the study period patient compliance varied from a low of 26.7% for sigmoidoscopy to a high of 61.7% for pneumococcal pneumonia vaccination. We feel this study has important implications for the US Public Health Service's preventive services screening goals for the year 2000.

INTRODUCTION

Computer-assisted systems to remind physicians to perform health maintenance and disease prevention procedures on their patients have existed for more than a decade.[1] Most studies show that physician and patient reminders are effective for most procedures, and that compliance with health maintenance recommendations (HMR's) is better when both are reminded.[2-5] Providers learn to rely on computer generated prompts, and do better when reminded at each patient visit.[6] Even with reminders, however, patient compliance with recommended procedures is low, rarely exceeding 50%.[7,8]

Few studies have detailed the change in patient compliance with HMR's over time following implementation of a computer-assisted reminder system. [9] This paper describes how the implementation of a reminder system changed patient compliance with recommended procedures.

METHODS

Background

Swedish Family Medicine Clinic is the ambulatory training site for 18 family practice residents. Six faculty also provide direct patient care. Faculty and residents see an average of 15 patients each per week in clinic. There were 17,578 patient visits in 1993 and 17,714 visits in 1994. There are an estimated 6000 "active" patients in the practice, of whom 1800 join or leave each year resulting in a 30% "turnover rate."

The Quality Care Program (QCP) is a comprehensive computer-assisted quality improvement system. It was designed by two of the authors (LAN and PAH) to provide improved disease prevention, cancer detection, immunization compliance, risk management, outcomes monitoring, and patient education.[10,11] The system was tested extensively in late 1992 and early 1993, and implemented clinic-wide in June of 1993.

QCP is an MS-DOS based program which runs on a single PC or on a PC network. The software generates a worksheet which is attached to the medical record at each visit. The worksheet shows completed and recommended health maintenance procedures based on nationally accepted guidelines. These HMR's are individualized depending on each patient's health risk factors. When the patient is initially registered in the system, the primary care physician fills out a one page questionnaire noting the patient's health risk factors and HMR status. Data from the visit worksheets and initial questionnaires are entered into the program's database by clerical staff. The clerk also prints the daily worksheets, monthly patient reminder letters, and periodic physician performance reports. Patients with HMR's that are due are mailed up to two reminder letters. If after one month the HMR is not performed, the patient is recorded by the system as a "non-responder" for that HMR.

0195-4210/95/$5.00

Table 1. Physician and Patient Compliance at Beginning and End of Study Period

Health Maintenance Recommendation	Number of Patients*		Physician Compliance+ (%)		Patient Compliance (%)		Patient Refused (%)		Patient Non Responder (%)	
	6/93	3/95	6/93	3/95	6/93	3/95	6/93	3/95	6/93	3/95
Cholesterol Screen	419	2,172	43.4	77.5‡	40.6	54.0‡	1.0	0.3	1.9	23.2
Fecal occult blood	125	507	35.2	80.3‡	29.2	49.3‡	1.6	0.6	4.0	30.4
Influenza Vaccine	95	469	17.9	86.4‡	13.7	33.7‡	3.2	1.1	1.1	51.6
Mammography	156	734	53.8	87.1‡	50.6	60.2∞	1.3	0.5	1.9	26.3
Measles-Mumps-Rubella	50	689	80.0	67.2	80.0	46.3‡	0	0	0	20.9
Oral Polio Vaccine	86	801	75.6	61.0∞	74.4	44.6‡	0	0	1.2	16.5
Papanicolaou Test	309	1483	59.2	90.8‡	56.0	59.3	0.6	0.5	2.6	31.0
Pneumococcal Pneumonia Vaccine	63	227	34.9	93.4‡	27.0	61.7‡	4.8	3.1	3.2	28.6
Rectal Examination	193	888	48.7	79.8‡	43.0	45.3	0.5	0.6	5.2	34.0
Sigmoidoscopy	111	453	27.0	50.6‡	21.6	26.7	4.5	2.0	0.9	21.9
Adult Tetanus Vaccine	426	2274	38.3	94.8‡	22.5	50.5‡	4.2	1.0	11.5	43.2

* Number of patients = Patients eligible to receive HMR procedure.
+ Physician Compliance = Patient Compliance + Patient Refused + Patient Non Responder. All others are considered "overdue."
‡ Chi-square difference between June 1993 and March 1995 significant at $p < 0.01$
∞ Chi-square difference between June 1993 and March 1995 significant at $p < 0.05$

Study Criteria and Design

The time frame for this study was from June 1993 through March 1995. To be included in the study, patients had to have been assigned to one of 14 physicians (11 residents and three faculty) who were in the training program during the entire time period. To exclude "inactive" patients, subjects were included only if they had been seen at least once during the last 15 months of the study.

Retrospective monthly reports were generated, including performance statistics on both physician and patient compliance with HMR's. To be "in compliance," a physician must have recommended the procedure to the patient, usually in the form of a reminder letter mailed to the patient. Patient compliance was defined as having received the recommended procedure. "Non-compliant" patients were further categorized as "non-responders" and "refused recommendation."

Billing data for the 14 physicians for four vaccinations - measles-mumps-rubella (MMR), oral polio (OPV), pneumococcal pneumonia, and adult tetanus - were also available for review. The billing data were not, however, filtered to exclude non-study patients.

RESULTS

There were 539 patients enrolled in the system at the beginning of the time period and 3046 enrolled at the end. Figure 1 shows enrollment over time. Physician and patient compliance rates at the beginning and the end of the study period for several HMR's is shown in Table 1. Differences between "in compliance" and "non-compliance" at the begining and the end of the study period were statistically significant (chi-square $p<0.05$) for most of the HMR's.

Data from the billing system are shown in figure 2. Patient compliance with several HMR's over time is shown in Figure 3.

DISCUSSION

The data presented here strongly suggest that patient compliance with many recommended health maintenance procedures rapidly improves following the implementation of an automated reminder system. By plotting patient compliance over time, we were able to show that the greatest rate of change occurred within 6 months of implementation, but then stabilized. Billing data for tetanus and pneumococcal pneumonia vaccines corroborates this finding, showing a rapid rise and ultimate plateau in the number of procedures performed.

The initial fall and susequent lower than expected rate in patient compliance with two childhood immunizations, MMR and OPV, is troublesome. The billing system data does not indicate a decline in these vaccination rates following QCP implementation.

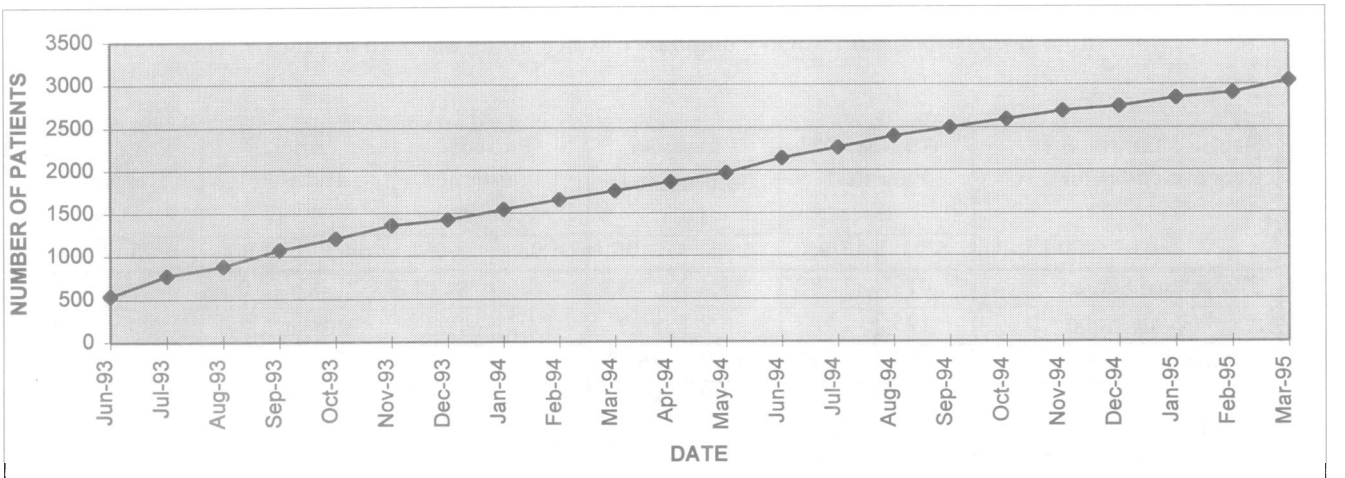

Figure 1. Enrollment of patients who met study criteria

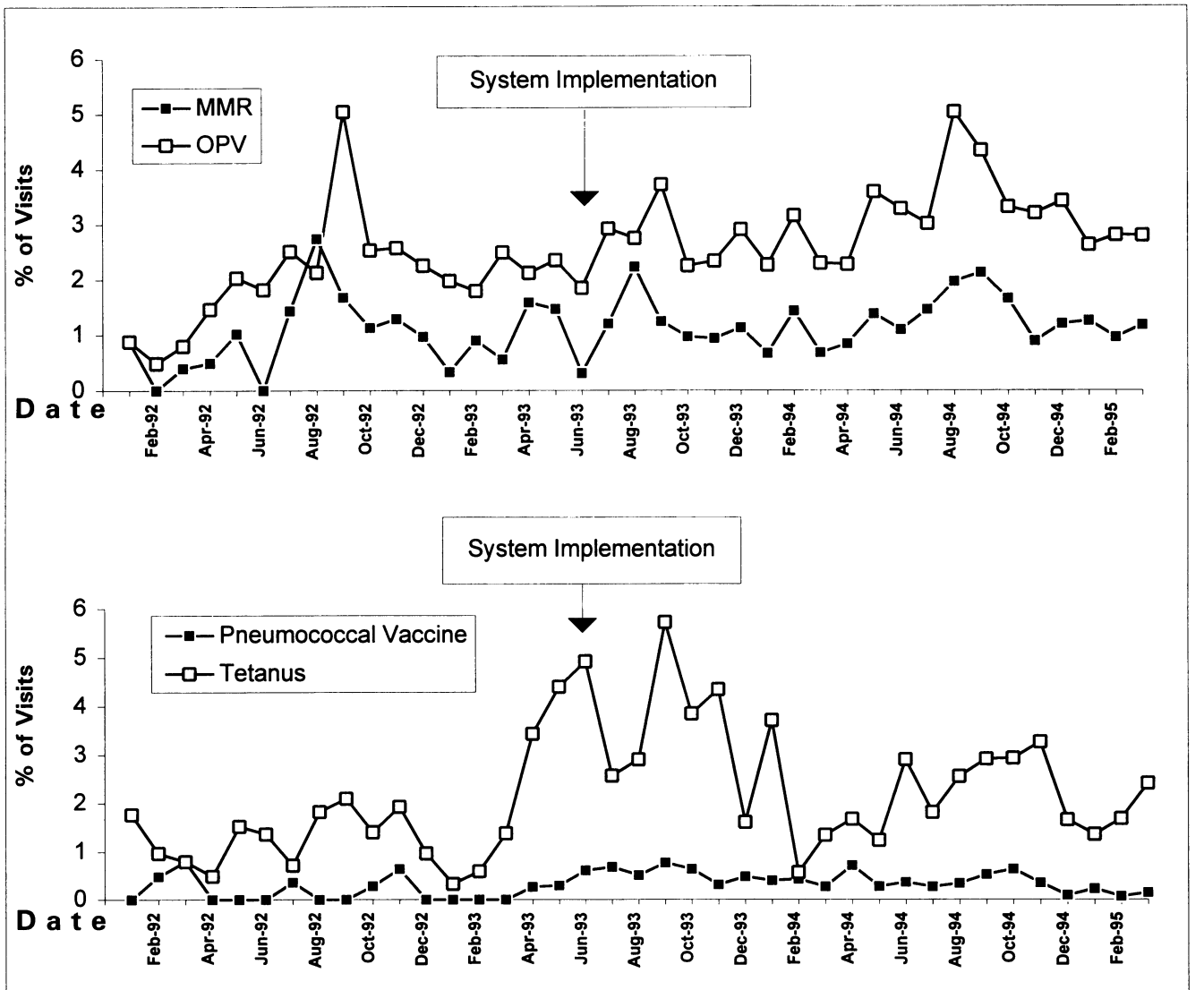

Figure 2. Billing system data for four immunizations: measles-mumps-rubella (MMR), oral polio (OPV), pneumococcal pneumonia, and adult tetanus. System implementation in June 1993. Percent of visits = number of procedures per 100 patient visits X 100.

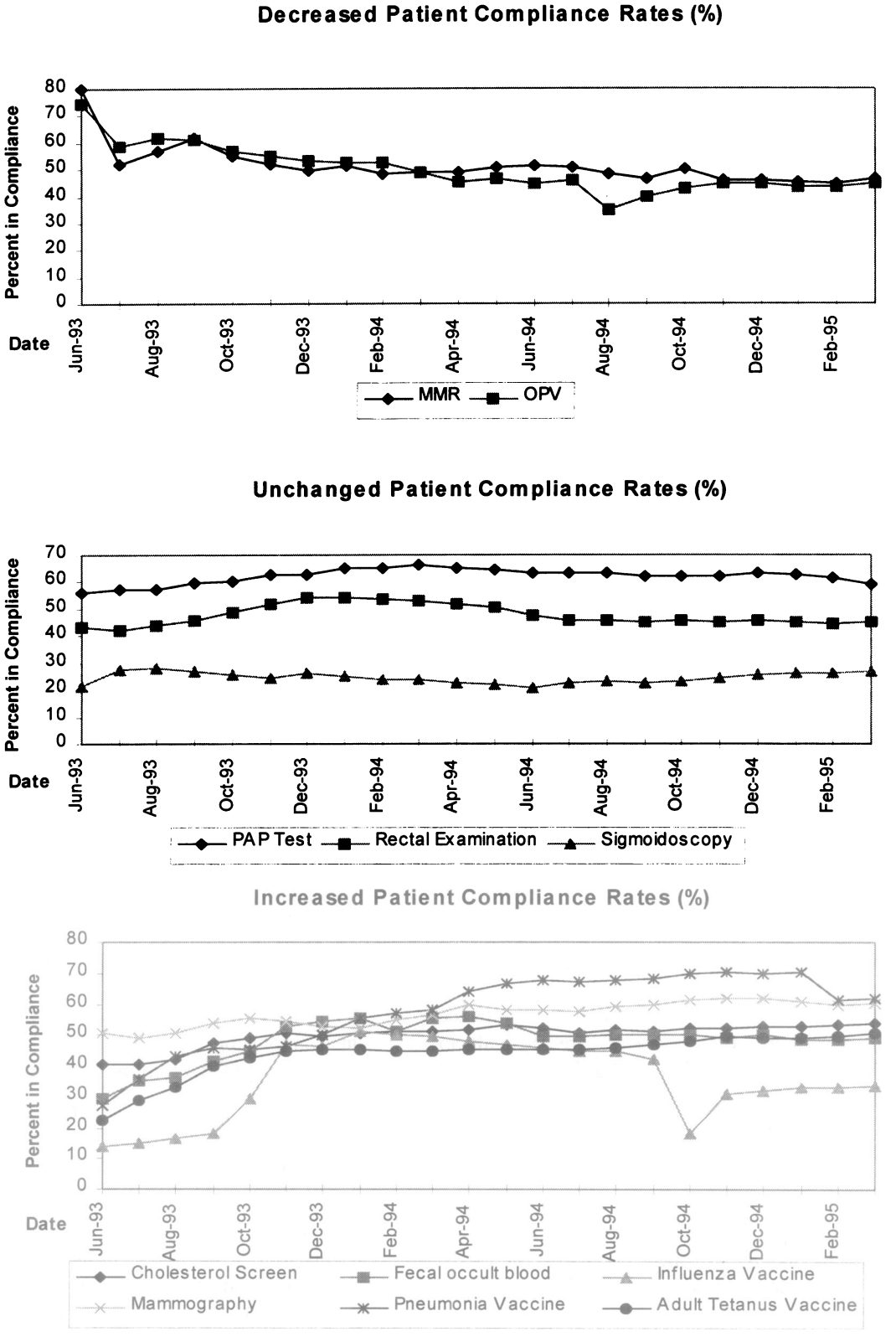

Figure 3. Patient compliance with health maintenance recommendations. Compliance with HMR's in the top and bottom graphs changed by at least 10% during the study period (chi-square difference between June 1993 and March 1995 significant at $p < 0.05$).

There are several possible explanations for the changes seen. Early on in system implementation, patients were given a one month "grace period" during which they were considered to be "in compliance." This allowed the clinic to send for outside records, if necessary, and avoided overwhelming the system with reminder letters. This was changed by January 1994. In addition during the study period the recommended ages for administering the first dose of MMR and the third dose of OPV were decreased from 15 months to 12 months and 6 months respectively. This resulted in more children who were behind on their immunizations. Finally, we suspect that children who joined the clinic were less likely to be up to date on vaccinations than those who left. Because of the 30% patient turnover rate, there was a constant influx of children who were behind on their immunizations, resulting in a lower than expected compliance rate. We are now performing a prospective study to assess this hypothesis.

The United States Public Health Service (USPHS) has established certain preventive services screening goals for the year 2000.[12] Target rates for cholesterol and cervical cancer screening are 75% and 85% respectively. While provider compliance for recommending these procedures met those goals, patient compliance fell short. We were, however, able to achieve a 60% mammography screening rate and 60% pneumococcal pneumonia vaccination rate as targeted by the USPHS. Our compliance results for these and other HMR's are similar to those noted in recent studies.[8,13]

In summary, we believe that computer assisted reminder systems can rapidly improve patient compliance with preventive services. Compliance rates higher than 70%, however, are difficult to achieve by these methods alone. Further research on additional techniques to improve patient compliance with HMR's is warranted.

REFERENCES

1. McDonald CJ, Hui SL, Smith DM, et al. Reminders to physicians from an introspective computer medical record. A two-year randomized trial. Ann Intern Med1984;100:130-8.

2. McDowell I, Newell C, Rosser W. Computerized reminders to encourage cervical cancer screening in family practice. J Fam Pract 1989;28:420-4.

3. Ornstein SM, Garr DR, Jenkins RG, Rust PF Arnon A. Computer-generated physician and patient reminders. Tools to improve population adherence to selected preventive services. J Fam Pract 1991;32:82-90.

4. Tape TG, Campbell JR. Computerized medical records and preventive health care. Success depends on many factors. Am J Med 1993;94:619-25.

5. Austin SM, Balas EA, Mitchell JA, Ewigman BG. Effect of physician reminders on preventive care: meta-analysis of randomized clinical trials. Proc Annu Symp Comput Appl Med Care 1994;121-4

6. Chambers CV, Balaban DJ, Carlson BL, Grasberger DM. The effect of microcomputer-generated reminders on influenza rates in a university-based family practice center. J Am Board Fam Pract 1991;4:19-26.

7. Garr DR, Ornstein SM, Jenkins RG, Zemp LD. The effect of routine use of computer-generated preventive reminders in a clinical practice. Am J Prev Med 1993;9:55-61.

8. Frame PS, Zimmer JG, Werth PL, Hall WJ, Eberly SW. Computer-based vs manual health maintenance tracking. Acontrolled trial. Arch Fam Med 1994;3:581-5.

9. Klachko DM, Wright DL, Gardner DW. Efect of a microcomputer-based registry on adult immunizations. J Fam Pract 1989;29:169-72.

10. Norman LA, Hardin PA. A multipurpose computer-assisted program to improve ambulatory medical care: a preliminary report. QRB 1990;16:364-72.

11. Norman LA, Hardin PA, Lester E, Stinton S, Vincent EC. Computer-assisted quality improvement in an ambulatory care setting: A follow-up report. Joint Comm J Qual Improv. 1995;21:116-31.

12. US Department of Health and Human Services Public Health Service. Healthy people 2000: national health promotion and disease prevention objectives. DSHS Publication No. (PHS) 91-50213, 1990.

13. Ornstein SM, Garr DR, Jenkins RG, Musham C, Hamadeh G, Lancaster C. Implementation and evaluation of a computer-based preventive services system. Fam Med 1995;27:260-6.